Early Journal Content on JSTOR, Free to Anyone in the World

This article is one of nearly 500,000 scholarly works digitized and made freely available to everyone in the world by JSTOR.

Known as the Early Journal Content, this set of works include research articles, news, letters, and other writings published in more than 200 of the oldest leading academic journals. The works date from the mid-seventeenth to the early twentieth centuries.

We encourage people to read and share the Early Journal Content openly and to tell others that this resource exists. People may post this content online or redistribute in any way for non-commercial purposes.

Read more about Early Journal Content at http://about.jstor.org/participate-jstor/individuals/early-journal-content.

JSTOR is a digital library of academic journals, books, and primary source objects. JSTOR helps people discover, use, and build upon a wide range of content through a powerful research and teaching platform, and preserves this content for future generations. JSTOR is part of ITHAKA, a not-for-profit organization that also includes Ithaka S+R and Portico. For more information about JSTOR, please contact support@jstor.org.

An attempt was made to explain the specimen on the ground that it was a hybrid, but there appear to be no two plants on Bering Island from which the characters found in Arcterica could be produced.—FREDERICK VERNON COVILLE, *Dept. of Agriculture, Washington, D. C.*

NEW PRECISION-APPLIANCES FOR USE IN PLANT PHYSIOLOGY.[1]

(WITH THREE FIGURES)

THE development of apparatus in this country for educational use in plant physiology has taken almost exclusively the direction of improvisation of the needful pieces from various existent physical, chemical, and mechanical articles, especially such as are very cheap and everywhere easy to obtain. In giving our inventions this turn it is evident that we have had in mind the needs of the smaller, poorer, and more backward institutions rather than the needs of the larger, richer, and more progressive; while, following the tendency usual in such cases, we have allowed ourselves to be carried to the extreme of reaction from the elaborate, costly, and mostly unpurchasable appliances previously used in this work. Improvisation has now, I believe, been carried to its utmost practical limit, and even to a greater extent than is educationally and scientifically desirable. Improvised apparatus certainly has its place and value, especially in that it permits the study of plant physiology in many places where otherwise it would be impossible, while its preparation cultivates a certain mechanical ingenuity and self-reliance. In general it is certainly true that such apparatus is vastly better than no apparatus. But it has also very great disadvantages, notably the waste of time commonly involved in its preparation and manipulation, in the inevitable inaccuracy of results, and above all in the wrong habit and erroneous ideal of scientific method inculcated by the use of such imperfect tools. Further, experience shows that the training in manipulation, while of value in itself, is gained at too great a cost of botanical training and knowledge; for usually the time and energy of the student are so fully absorbed in the preparation of the apparatus that he has little of either remaining for use in the study of the plants.

These facts, I believe, indicate that the next step needful in plant physiology is a movement to what may be called normal apparatus, viz., pieces manufactured especially for the particular purpose, yielding accurate quantitative results, capable of application to their work with convenience and economy of time, and purchasable from the stock of supply companies precisely as apparatus for physics and chemistry may be. With these ideas in mind I have been trying for some two years past to develop such pieces of normal apparatus for all of the principal physiological processes, and some of the results are described below, while descriptions of others are to follow later. I have had in mind primarily their educational use, but they should also be available for investigation, especially the investigation of those physiological life-histories of plants which will form a leading feature of the ecology of the near future. In their construction, scientific efficiency (involving accurate mechanical workmanship), has been the first consideration, practical convenience and economy in manipulation the second, availability for purchase by all who have the means and wish to buy them the third, while the matter of cost has come last. I have confidence that a people so devoted to efficiency, and so wealthy, as the Americans, will ultimately not begrudge the cost of really good educational appliances, though I expect that their introduction will be very slow. In order to make them generally available I have arranged for their manufacture and sale by the Bausch & Lomb Optical Co., of Rochester, N. Y., who will presently be prepared to supply them along with other articles, chemicals, etc., needed for work in plant physiology.

---

[1] These appliances, with others to be described later, were exhibited and explained at the Philadelphia meeting of the Society for Plant Morphology and Physiology, December 30, 1903.

The reader interested in these matters will note that this is not the first attempt to provide such apparatus. Professor J. C. Arthur, of Purdue University, some years ago offered for sale several excellent pieces designed by himself, though apparently he has not continued their development. The field is open to all, and from the many pieces likely to be offered in the near future it is probable that the survival of the fittest will provide us with physiological apparatus of great exactness and convenience and of moderate cost.

I. CLINOSTAT.

The most essential single piece of apparatus in the laboratory of plant physiology is a clinostat. Several forms have been invented, of which the best known are the Pfeffer-Albrecht, the Wortmann, and the Hansen, all of German make and more or less costly and difficult to obtain, while several home-made forms have been described by American botanists.

My instrument is illustrated in the three accompanying figures. It consists essentially of the works of a powerful American eight-day clock, geared to a revolution in fifteen minutes, inclosed in a practically dust- and moisture-tight metal case, capable of being used in any desired position. Used vertically (*fig. 1*) it stands upon three leveling-legs and carries a disk with a rim holding a 4-inch pot saucer (to take up leakage from the pot), in which may be set any size of pot up to 5-inch, though in this position it will carry a still heavier pot. In this figure may also be seen, on the left of the spindle, the nut by which the works are started or stopped, and the covers of the winding-holes. It can, of course, be wound without disturbing the plant. Used horizontally (*fig. 2*) it may, by means of the perforated screw-posts and clamping-screws on the back of the case, be fixed at any desired height on the vertical rod of any common laboratory support. The spindle rod, either carrying a plant attached by

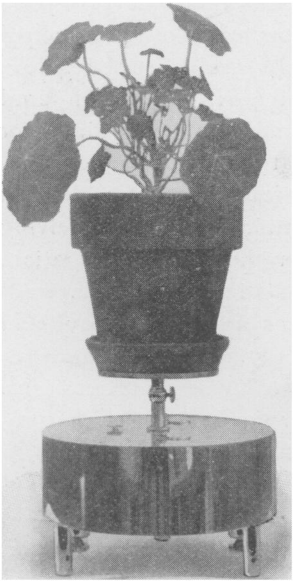

FIG. 1.

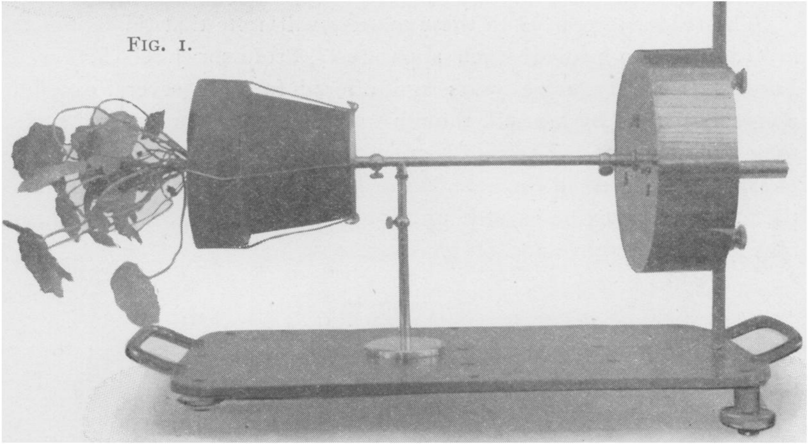

FIG. 2.

copper wire[4] to the perforated disk, as shown in the figure, or else carrying a pot, a peat-block, or a cork into a moist chamber, is supported near its distal end by a simple Y-support adjustable for height. In this position the instrument carries perfectly a 4- or 5-inch pot, and presumably a heavier one if well centered. Clamped upon a horizontal rod (*fig. 3*) it may also be used at any angle whatsoever, including complete inversion, the latter feature being, I believe, possible with none of the other obtainable forms.

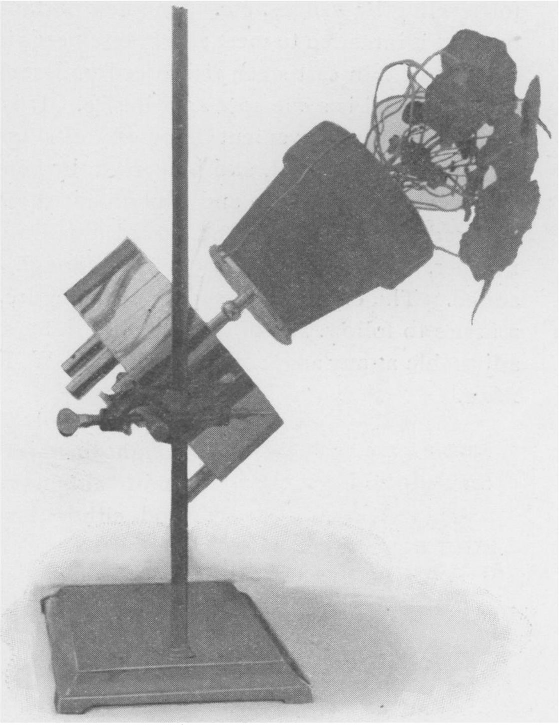

FIG. 3.

Its special merits are its length of action (two days with one winding), entire efficiency in any position, compactness (whereby it may readily be placed under bell-jars, etc.), and moderate cost. Its demerits are its inability to carry plants of over 4- or 5-inch pot (though it is extremely rarely, and in educational demonstration never, the case that heavier plants are used), its single speed (though other speeds are extremely rarely, and in educational demonstration work never, needed), and its audible tick, which however is of a brisk and cheery character, quite in place in a laboratory.

II. PORTABLE CLAMP-STAND.

For many purposes in experimental plant physiology some form of clamp-stand, to support apparatus in special positions, is necessary, and one of the forms used in chemistry is generally adopted. For the simpler uses, these answer perfectly; but when several pieces must be supported near together, and when some articles must be set level, and especially where the whole must be removed from greenhouse or wardian case to lecture or laboratory table, it is necessary to improvise some form of tray or other support to carry the stands, with a device for leveling by wedges, etc. The new portable clamp-stand illustrated in *fig. 2* is intended to meet all of these needs in a single instrument. It is made of thin cast steel, reinforced underneath on the margin and at the holes, and is some $40 \times 22^{\text{cm}}$ in size. It is perfectly plain on top, is provided with convenient handles, rests upon three legs in which leveling-screws are set, and is pierced by holes for the upright rods at points where experience and experiment show these to be most needed. The rods are of the size and thread usual in chemical supports, two in number, one 50 and one 25^{cm} long, though of course others can be added. The clamps, not shown in the figure, but to be illustrated in a figure to follow, are of a new form, light, strong, and firm, and are adjustable at any angle or in any plane.—W. F. GANONG, *Northampton, Mass.*

---

[4] So in the figure, but the completed instrument is to have screw rods instead of the wire.

(*To be continued.*)